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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/667,666	09/23/2003	Wen-Chang Chen	CHEN3587 / EM	9104
23364	7590	11/16/2004	EXAMINER	
BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314			ZIMMER, MARC S	
			ART UNIT	PAPER NUMBER
			1712	

DATE MAILED: 11/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/667,666

Applicant(s)

CHEN ET AL.

Examiner

Marc S. Zimmer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurosawa et al., U.S. patent # 6,011,123. Kurosawa discloses (abstract) a curable resin composition, and an insulating dielectric film formed therefrom, comprising a partial condensate of an organosilane, polyamic acid gearing a hydrolyzable silane moiety, a transition metal chelate catalyst, a catalyst inhibitor (column 16, lines 27-60), and a curing accelerator including any of the inorganic acids outlined in column 17, lines 2-8.

Discussion of the silane derivatized polyamic acid and its preparation begins in column 4, line 49 and continues through column 14. Of particular relevance to step (a) of both claims 1 and 8, a process wherein a tetracarboxylic acid dianhydride and a diamine are polycondensed to obtain a polyamic acid followed by reaction with a silane having hydrolyzable groups and a functional group reactive with a carboxyl group is taught in the column 9, lines 63-67 through column 10, lines 47-51. Polyamic acid formation preferably occurs at a temperature of between 0° and 120° C (column 14, lines 33-38). A generic representation of the polyamic acid backbone is provided in formula (4) in column 5. Thereafter, various embodiments of R³ are delineated where R³ denotes the structural framework of the aromatic moiety contributed by the

dianhydride. At least several of these entries correspond to dianhydrides mentioned by Applicant in claims 3 and 9. For instance, where R^3 in formula (4) is the first radical outlined in column 6, the polyamic acid is derived from pyromellitic dianhydride which is the first compound recited in each of these claims. R^4 in formula (4) denotes the structural framework of the aromatic moiety contributed by the aromatic amine. At least several of these entries correspond to aromatic amines mentioned by Applicant in claims 4 and 10. For instance, where R^4 in formula (4) is the second radical exhibited in the second line of structural embodiments outlined in column 6, the polyamic acid is derived from 4,4'-oxy-dianiline which is the first compound recited in each of claims 4 and 10.

Silanes bearing a group that is reactive towards carboxyl groups within the polyamic acid framework are outlined in column 12, lines 34-67 through column 13, lines 1-15. Some of these including 3-aminopropyltrimethoxysilane and 3-aminophenyltriethoxysilane coincide with the silanes identified by Applicant in claims 5 and 11 as being useful for derivatizing the polyamic acid.

As for Applicant's requirement that the equivalent ratio of diamine to dianhydride is less than 2:1, this aspect is inherently satisfied by the reference insofar as there would be no carboxyl groups available to react with the amino-functional silane had more than two equivalents of the aromatic diamine been made available.

Concerning step (c) of claim 1 and step (d1) of claim 8, Kurosawa provides for both the preparation of the silsesquioxane prior to combining it with the poly(amic acid) and *in situ* preparation of the silsesquioxane thus covering the different approaches

taken by claims 1 and 8 (see processes 3 and 1 respectively in column 18 of the reference). A fairly comprehensive list of the organosilicon precursors is volunteered in column 3, lines 56-67 through column 4, lines 1-28. Notably the most favored embodiments of the silane (column 4, lines 24-28) adhere to the structural description of the corresponding monomer and silicon alkoxide of claims 1, 6, 8, and 12. There is no mention of the pH at which polycondensation is carried out (claim 1) but it is the Examiner's position that, where the accelerator is one of the inorganic acids listed at the top of column 17, the pH will inherently be satisfied insofar as Applicant advocates the utilization of these same condensation catalysts on page 11 of their Specification.

Concerning step (d) and (d1) of claims 1 and 8 respectively, the reference only expressly teaches the amount of water to be added for preparing the silicon-based polymer component (column 18), not the amount required to hydrolyze the silyl groups bonded to the polyamic acid. Nonetheless, the skilled artisan will appreciate that the hydrolyzable groups of a silane/silane-functionalized compound must be hydrolyzed in order to be rendered condensation-active. In this connection, one of ordinary skill will optimize the quantity of water as a matter of routine experimentation to ensure the full hydrolysis of the silane thereby enabling it to react with another condensation-active compound (in this case to enable reaction of the silane-functionalized polyamic acid with the inorganic silane condensate). Ion-exchanged water is disclosed several times in the examples for hydrolyzing the organosilicon-containing compounds.

As for step (e) and (e1) of claims 1 and 8 respectively, coating of the composition onto a surface and curing at 350° C is described in column 20, lines 58-67. Of course,

imidization of the polyamic acid to polyimide will inherently occur under these conditions. (As evidence of this, see column 14, lines 39-43.)

Concerning claim 2, Example 10 teaches the removal of methanol by-product *in vacuo* prior to adding the polyamic acid.

The prior art discloses several other methods that are quite similar to the claimed invention. Brown et al., U.S. patent Nos. 5,962,113 and 5,883,219 teach methods of making inorganic-organic hybrid polymers, and films therefrom, that mirror the instant invention in most every respect. In each reference, a dielectric material comprising the reaction product of alkoxysilane-functionalized polyamic ester and organic polysilica, which is equivalent to the silsesquioxane of the instant invention is disclosed. There are, however, a couple of important distinctions. First, the polyimide precursor is derived from the reaction of an aromatic diamine with an aromatic diester-diacyl chloride as opposed to an aromatic dianhydride. Further, the amino-functional silane is introduced during the formation of the polyamic ester backbone as opposed to afterward as claims 1 and 8 require. Although the final product, polyimide-silsesquioxane copolymer, is precisely the same, Brown employs a somewhat different process and the Examiner could conceive of no reason why the skilled artisan would be motivated to alter that process in such a way that the instant invention is realized.

Aoki et al., Japanese Patent Document No. 4-189866 A is also of interest for its disclosure of a reaction product derived from (i) a product of organosilsesquioxane and an amino-functional silane and (ii) polyamic acid. Clearly, the difference in this instance

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is that the inorganic silsesquioxane component has been pre-modified instead of the organic component

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marc S. Zimmer whose telephone number is 571-272-1096. The examiner can normally be reached on Monday-Friday 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on 571-272-1302. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

November 12, 2004

Marc Zimmer

Marc Zimmer